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Health costs and benefits associated with economic transitions: Linking records of address change, property value, and self-reported health

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Abstract

Deprivation is a major risk to population health, in particular when experienced during childhood. Poor health in the early years accumulates and is expressed in adult health inequalities. Policy makers may aim to mitigate against the ill effects of deprivation by trying to increase social mobility and facilitating moves towards better earnings and living conditions or by protecting against the effects of downward moves and the experience of deprivation. This paper uses address change and property value data at the individual and family level to examine whether poor health outcomes occur more frequently among people who move between addresses and particularly those who move to properties with lower property values. We use the Northern Ireland Longitudinal Study, linking health and demographic data from 2001 and 2011 Censuses to house valuations for a representative 28% of the population aged 10–64 years (N = 342,681). Young persons (aged 10–15 years) living in a house valued at over £160,000 were half as likely to be reported as having mental ill health as those living in a house valued under £75,000 (OR = 0.49, CI: 0.31–0.78). There was no strong evidence that upward or downward mobility affected mental health or physical health for young people, but ill health of working aged persons showed a strong association with moving to houses of lower value. Results are discussed in terms of their implications for understanding the dynamics of social mobility and health and in terms of how various policies towards poverty may influence population health.

KEYWORDS
administrative data linkage, mental health, social mobility

1 | INTRODUCTION: SOCIAL MOBILITY AND HEALTH

(There is) this assumption that rising to a middle class life must be the aim of everybody and the final example of human happiness. When of course you meet middle class people and so many of them are intensely miserable for various reasons, you start to wonder about that idea. Zadie Smith, BBC (2013)

This Strategy restates the Government's commitment to tackle poverty at its source – be it family breakdown,

> *educational failure, addiction, debt or worklessness*. Ian Duncan-Smith, Child Poverty Strategy (2014)

There have been recent attempts to refocus the study of health inequalities on the systems and social structures that underpin them (cf. Lynch, 2017; McCartney et al., 2019). Evidence points to healthier populations in countries with lower systemic inequality (Wilkinson & Pickett, 2009) and greater emphasis on welfare and social security (McAllister et al., 2015; McCartney et al., 2019). This gives impetus to researchers to look closely at emerging evidence adding to understanding on social gradients of health and to examine how these patterns reflect the societal context in which they occur.

Governments around the world vary in the extent to which they prioritise, and how they address, the issue of poverty. In the United Kingdom, successive Westminster governments have emphasised the root causes of poverty as their policy focus, with greater social mobility and opportunity for economic advancement identified as remedies, as exemplified by the above quote from the 2014 Child Poverty Strategy by the then Work and Pensions Secretary. Given the known costs to health of economic deprivation, particularly during childhood, social mobility and the opportunity to achieve greater affluence would appear to be a route to better health (Cardano et al., 2004; Hahn & Truman, 2015; Sage, 2013).

However, social mobility as a policy goal has been under a critical spotlight for some time. Educational expansion and labour market activation as policy responses to poverty reflect a framing of the issue at the level of the individual and in terms of why certain individuals find themselves in poverty (Leeman et al., 2016). Successful implementation of such policies might give those same individuals competitive advantages for the attainment of greater wealth. However, this emphasis displaces from the policy discourse any structural analysis of underlying social stratification and casts social protection for those out of work and in poverty as a second-order priority (Van Berkel, 2010).

Greater affluence and prosperity is consistently associated with better physical and mental well-being, whereas illness disproportionately affects those experiencing greater socio-economic deprivation (Marmot, 2017). Childhood socio-economic conditions have been shown to impair long-term cognitive development and well-being, independent of conditions experienced later in life (Hayward & Gorman, 2004; Schoon et al., 2012).

However, while persistent deprivation and stable affluence represent the least and most salutogenic social circumstances (Forrest et al., 2018), there is mixed evidence as to whether increasing one's income, social class, or social status will bear dividend for health. This literature is beset by complexity, particularly around the degree to which moving from deprivation directly causes health improvement and to which health is an advantage or even a prerequisite for economic advancement (Boyle et al., 2009; Doyal & Gough, 1991). In the absence of significant economic growth or reordering of class structures, opportunities for upward social mobility necessitate others moving downward (Bushcha & Sturgis, 2018). Given that the salience of a loss often exceeds that of a gain (Kahneman & Tversky, 1979), we might expect the emotional cost of a loss of social class status might exceed the benefit accrued to those moving in the other direction.

Furthermore, different accounts exist for how socio-economic advantage translates to health benefits: from psychosocial costs such as status anxiety (Wilkinson & Pickett, 2009), children's exposure to emotional distress (Treanor, 2016), to material benefits such as quality housing and car access (Dunn, 2002; Robertson et al., 2015). This study avails of linked data on address change and estimated house value to contextualise the distribution of health and ill health. Through the use of the Northern Ireland Longitudinal Study, health as reported on the 2011 Northern Ireland Census could be analysed for a large proportion of the NI population. Although it is challenging to deduce the precise causal effect of changes of address and occupation over a 10-year period, the longitudinal structure and large sample size of these data render them useful for further unpacking how these changes in material circumstances relate to physical and mental health.

2 | HEALTH IMPACTS OF SPATIAL AND RESIDENTIAL MOBILITY

> *(Our) task is ownership for all. The desire to have and to hold something of one's own is basic to the spirit of man*. Margaret Thatcher (1985)

> *One of the gifts that supposedly come with a middle class and upper middle-class life is this isolation: living in a house which is only yours; if you are fortunate enough you do not have to speak to your neighbours … the higher you go the less contact you have with other people. That's the ideal: that at some point you'll have this perfect isolation*. Zadie Smith, BBC (2013)

The opportunity of moving to better quality housing represents a material improvement in circumstances and environment offered by social mobility, which could be expected to improve health outcomes (Battel-Kirk & Purdy, 2007; Dunn, 2002). Furthermore, the built environment and norms within a neighbourhood can influence an individual's behaviour and attitudes around physical health and personal resilience (Commission on Social Determinants of Health, 2008; Thomson, Thomas, Sellstrom, & Petticrew, 2013). A report by Shelter found that doctors viewed poor housing conditions as driver of mental ill health. However, the same study reported that members of the general public identified affordability as the main factor having a negative impact. This highlights the complexity of upward mobility being expressed in moves to higher value property, in that material conditions may improve but financial demands may introduce strain.

Furthermore, change and upheaval are often stressful. Major life events, such as bereavement, job-loss, or loss of a family home can severely impact mental health (Holmes & Rahe, 1967; Moriarty, Maguire, O'Reilly, & McCann, 2015; Maguire et al., 2016). As well as

benefits, improvement in socio-economic conditions can introduce disruptions to normal life, including to childcare arrangements and children's routines (Speirs et al., 2015). In a synthesis of available evidence on the impact of instability on child development, Sandstrom and Huerta (2013) argued that a change of address may place demands on young people's psychosocial resources, in particular through disruption to their peer relationships. Both change of residence and change of financial state were included in the original Social Readjustment Scale, which weighted the impact of major life events (Holmes & Rahe, 1967). Moves to less desirable homes may be indicative of involuntary mobility, which influences family-level stress through the removal of control and reduction in self-efficacy, particularly in instances of foreclosure (Sandstrom & Huerta, 2013). Additionally, Rumbold et al. (2012) found disruptive effects of house moves on young people, regardless of whether the move represented an upward or downward transition. Further mechanisms underlying this disruption may include the diversion of parents' energy and time onto the moving process, as well as the disorienting effect of the changed physical surroundings. Popham, Williamson, and Whitely (2014) found evidence of decline in health in the period preceding a change of address, although noted that there was no evidence that these declines would endure. This suggests that benefits of mobility need to be of sufficient magnitude to outweigh and outlast any health costs arising from upheaval.

Much research on residential mobility and health revolves around transitions between different housing tenures, from renting to home ownership and vice versa. Living in rented accommodation is characterised as stress enhancing both in terms of social status (Gregory et al., 2018) and of accumulation of stressors (Robertson et al., 2015). However, Smith et al. (2003) argued that although owner-occupation has health benefits, the emotional stress and practical difficulties in obtaining homeowner status and maintaining a home in suitable condition can also cause damage to health. Baker, Bentley, and Mason (2012) found no evidence of mental health dividend from moves between renting and home ownership, whereas Popham et al. (2014) also found no evidence of improvements to mental health among people who had availed of the Right to Buy their socially rented property. However, introducing a further level of complexity, Mason et al. (2013) suggested that the mental health impact of housing affordability may be less for home owners than for private renters. This latter study highlights the potential value of using data, which simultaneously captures changes in housing tenure as well as the value the properties being moved from and moved to.

3 | INVESTIGATING RESIDENTIAL MOBILITY USING THE NORTHERN IRELAND LONGITUDINAL STUDY

The Northern Ireland Longitudinal Study (NILS) is a representative 28% sample of the NI population, linking health card registration data to Census returns, vital events, and other administrative records.[1] Persons born in or arriving in NI are added to the NILS if they have one of 104 birth dates. By the end of the 2011 Census, there were over 530,000 NILS members. Using unique identifiers for members of the cohort, researchers can link NI Census data for different years for people enumerated in each of those years.[2] Information from the 2001 and 2011 Censuses included sex, approximate age, marital status, household composition, tenure of household, and social class as determined by occupation and type of employer. An advantage of using data on this size of sample is the opportunity to detect associations within relatively small groups and, thus, to adjust for a large set of potentially confounding covariates.

NILS has been used previously to advance knowledge of residential mobility within Northern Ireland. Through linkage to address change data as captured in the Northern Ireland Health Card Registration system (NIHCR), Shuttleworth, Barr, and Gould (2013) found that internal migration in Northern Ireland is strongly patterned by social class characteristics of individuals and areas. More deprived areas experienced net out-migration between 2001 and 2007 whereas less deprived areas experienced net in-migration. Internal migration during this period was found to be more likely among Catholics, among people with more education and among healthier people.

Health outcomes for this study were determined from the 2011 NI Census in which a range of questions were asked about health conditions. Physical ill health was defined as having a health problem or disability which limited day-to-day activity and lasted at least 12 months. Mental ill health was defined as a positive response to the question "Do you have any of the following conditions which have lasted, or are expected to last, at least 12 months?": "an emotional psychological or mental health condition such as depression or schizophrenia." Prevalence of these two items in 2011 is shown in Figure 1.

The address at which NILS members were registered at the times of the 2001 and 2011 censuses were linked to data collected by the Land and Property Services on the rateable monetary value of each property on 1 January 2005 (https://www.finance-ni.gov.uk/topics/property-valuation/domestic-valuation, c.f. LPS, 2019). This allowed us to capture moves between properties of different values between 2001 and 2011. Additionally, records of address change captured through health card registrations with and record updates of General Practitioners provide a measure of the number house moves in the intercensal period.

Comparing health status of individuals and different value properties is not a new idea (cf. Blau & Haurin, 2016; Harkness et al., 2009). However, whereas the above studies were reliant on average value at a district level and referring to a single prior point in time, linkage to the NILS allows for improvement in two key respects. First, property value is captured at the household level and linked to the individual. Second, we capture social and residential mobility by linking the valuation to addresses occupied at two time points: the times of the 2001 and 2011 censuses. Using this single stable value index linked to addresses occupied at each time point, we can measure to what extent health outcomes are associated with both prior and recent socio-economic conditions, and with transitions between these. House values are grouped into five categories based on the NI house market in 2005, £0–75,000; £75,001-95,000; £95,001–120,000;

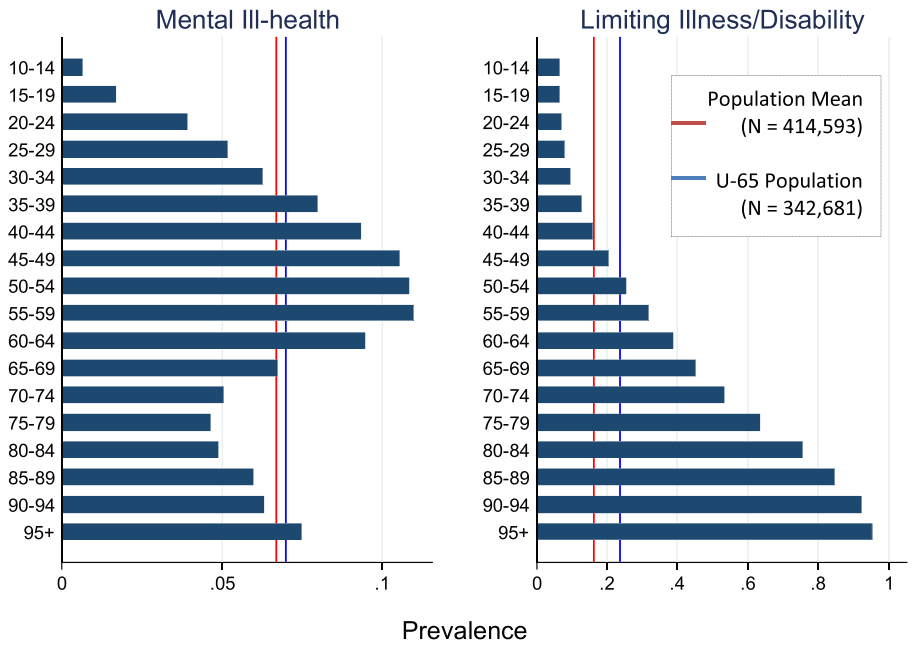

FIGURE 1 Prevalence of ill health by age

£120,001–£160,000; £160,000+ (cf. McCann, Grundy, & O'Reilly, 2012). House value transition was computed as the difference between the house value band in 2011 and 2001, giving a score between −4 (moved to home 4 bands lower on the scale) to +4 (moved to home 4 points higher).

4 | HYPOTHESIS AND ANALYTICAL STRATEGY

Our central hypothesis is that moving to a property of a different value is associated with differential risk of mental and physical ill health, with "upward" moves to higher value properties associated with lower health risk and "downward" moves to lower value properties associated with greater risk of ill health. This hypothesis encompasses the possibilities that changing of address the predicted patterning may only affect physical or mental health; that upward transitions are correlated with lower ill health, but with no corresponding association between downward transitions and greater ill health; or the reverse, that downward transitions are correlated with greater likelihood of ill health whereas upward transitions are not correspondingly predictive of better health. The hypothesis would not be supported by showing associations between health and the value of properties currently or historically occupied (which we expect based on the literature) if these are in the absence of any further association between value differential and risk to health.

We test this hypothesis by comparing across logistic regression models of physical and mental ill health, stratified by age group. An individual's health could be correlated with changes in their property value because of confounding correlated effects. The following factors associated both with poor health and with house value are adjusted for in regression models: household tenure, household occupational socio-economic status, the number of family members with a long-term limiting illness, household structure, and prior general health. Additionally, sex and age, which come to affect personal levels of affluence and mental health risk in later life, are included in models for emerging adulthood and working age groups.

Two alternative possibilities were tested: a "starting disadvantage" model, where value of prior property (2001) is the main predictor, and a "cumulative advantage" model, which included both 2001 and 2011 house value. The "mobility account" implied by the central hypothesis was modelled using the 9-point house value change scale, with adjustment for 2001 house value to test whether, after accounting for initial position, change in house value independently contributes to health status. Analysis was carried out using Stata Version 16 (StataCorp, 2019).

We conducted additional sensitivity analyses in order to test robustness of any observed associations. First, by excluding persons with long-term limiting illness in 2001, we could make an initial estimate of the degree to which health influences on deprivation accounted for any significant associations. Second, we excluded persons living at the same address in 2001 and 2011. Here, if average associations were to change substantially, this would give some indication to what degree associations were due to effects of relocation.

5 | RESULTS

The total number of NILS members aged 10–15 years in 2011 for whom data from the 2001 census were also available was 38,612, whereas 44,886 were aged 16–24 years. Descriptive statistics presented in Table 1 demonstrate an even gender split in both age groups. Poor mental health is more prevalent in the emerging adulthood group (∼3% vs. <1% in the youth group). Limiting illness occurred in a similar

TABLE 1 Descriptive statistics by 2011 age group

		Youth (10–15; *N* = 38,612)	Emerging adulthood (16–24; *N* = 55,686)	Working age (25–64; *N* = 233,784)
Mental ill health		286 (0.74%)	1639 (2.94%)	21,918 (8.82%)
Limiting ill health		2550 (6.60%)	3889 (6.98%)	49,193 (19.81%)
Age (2011)		12.56	19.89	43.95
Sex	Male	18,632 (51.13%)	26,341 (50.18%)	111,771 (47.81%)
Household Structure (2001)	Mother & Father	24,289 (62.91%)	34,741 (62.39%)	**Married w/children** 83,909 (35.89%)
	Single parent	7359 (19.06%)	12,005 (21.56%)	**Married no children** 17,081 (7.31%)
	Reconstituted/step family	119 (0.31%)	987 (1.77%)	**Unmarried partner w/children** 4273 (1.83%)
	Alternative household structure	1879 (4.87%)	1840 (3.3%)	**Unmarried partner no children** 5923 (2.53%) **Single parent** 16,212 (6.93%) **Lives alone** 13,914 (5.95%)
	Missing information	4966 (12.86%)	6113 (10.98%)	**Lived with both parents** 39,885 (40.15%) **Lived with one parent** 14,047 (14.14%) **Lived in reconstituted/ step family** 1187 (1.19%) **Alternative household structure** 6702 (6.75%) **Missing** 37,514 (37.77%)
Socioeconomic classification (or of reference family member, 2001)	Long-term unemployed	1605 (4.16%)	2243 (4.03%)	10,653 (5.39%)
	Routine/semi-routine	7471 (19.35%)	12,356 (22.19%)	59,117 (29.90%)
	Lower technical	2466 (6.39%)	4137 (7.43%)	16,961 (8.58%)
	Own business	1697 (4.4%)	3224 (5.79%)	9031 (4.57%)
	Lower professional	15,650 (40.53%)	22,318 (40.08%)	69,241 (35.02%)
	Higher professional	4124 (10.68%)	4652 (8.35%)	11,700 (5.92%)
	Missing information	5599 (14.5%)	6756 (12.13%)	20,999 (8.05%)
General Health (2001)	Poor health	556 (1.44%)	693 (1.24%)	16,046 (6.86%)
	Fairly good health	2607 (6.75%)	3303 (5.93%)	35,015 (14.98%)
	Good health	30,583 (79.21%)	45,856 (82.35%)	146,641 (62.72%)
	Missing information	4866 (12.6%)	5834 (10.48%)	36,082 (15.43%)
Number of others in household with long-term limiting illness		0.13	0.17	0.08
Moved address between 2001 and 2011		17,489 (47.52%)	24,720 (46.60%)	121,683 (51.32%)
Number of moves (if moved)		1.77	1.80	1.71
Property value difference (if moved)		+£24,893	+£12,264	£8557
Value 2001	<75,000	7923 (20.52%)	11,785 (21.16%)	47,474 (21.59%)
	75,000–95,000	6596 (17.08%)	10,018 (17.99%)	40,072 (18.22%)
	95,000–120,000	5981 (15.49%)	8146 (14.63%)	34,380 (15.63%)
	120,000–160,000	6032 (15.62%)	8741 (15.7%)	36,154 (16.44%)
	160,000+	7330 (18.98%)	10,164 (18.25%)	40,675 (18.50%)
	Missing information	4750 (12.3%)	6832 (12.27%)	21,163 (9.62%)

(Continues)

TABLE 1 (Continued)

		Youth (10–15; *N* = 38,612)	Emerging adulthood (16–24; *N* = 55,686)	Working age (25–64; *N* = 233,784)
Value 2011	<75,000	6097 (15.79%)	10,752 (19.31%)	42,355 (19.92%)
	75,000–95,000	5963 (15.44%)	9504 (17.07%)	37,065 (17.43%)
	95,000–120,000	6198 (16.05%)	8677 (15.58%)	36,554 (17.19%)
	120,000–160,000	6840 (17.71%)	9631 (17.3%)	38,488 (18.10%)
	160,000+	8992 (23.29%)	11,351 (20.38%)	44,293 (20.83%)
	Missing information	4522 (11.71%)	5771 (10.36%)	13,866 (6.52%)
Rent-type 2001	Not renting	24,788 (64.2%)	36,989 (66.42%)	157,974 (67.57%)
	Social renting	6263 (16.22%)	9967 (17.9%)	30,334 (12.98%)
	Private renting	2690 (6.97%)	2919 (5.24%)	11,902 (5.09%)
	Missing info	4871 (12.62%)	5811 (10.44%)	33,574 (14.36%)
Rent-type 2011	Not renting	28,739 (74.43%)	37,647 (67.61%)	174,632 (74.70%)
	Social renting	4895 (12.68%)	7410 (13.31%)	26,479 (11.33%)
	Private renting	4577 (11.85%)	9202 (16.52%)	29,022 (12.41%)
	Missing info	401 (1.04%)	1427 (2.56%)	3651 (1.56%)

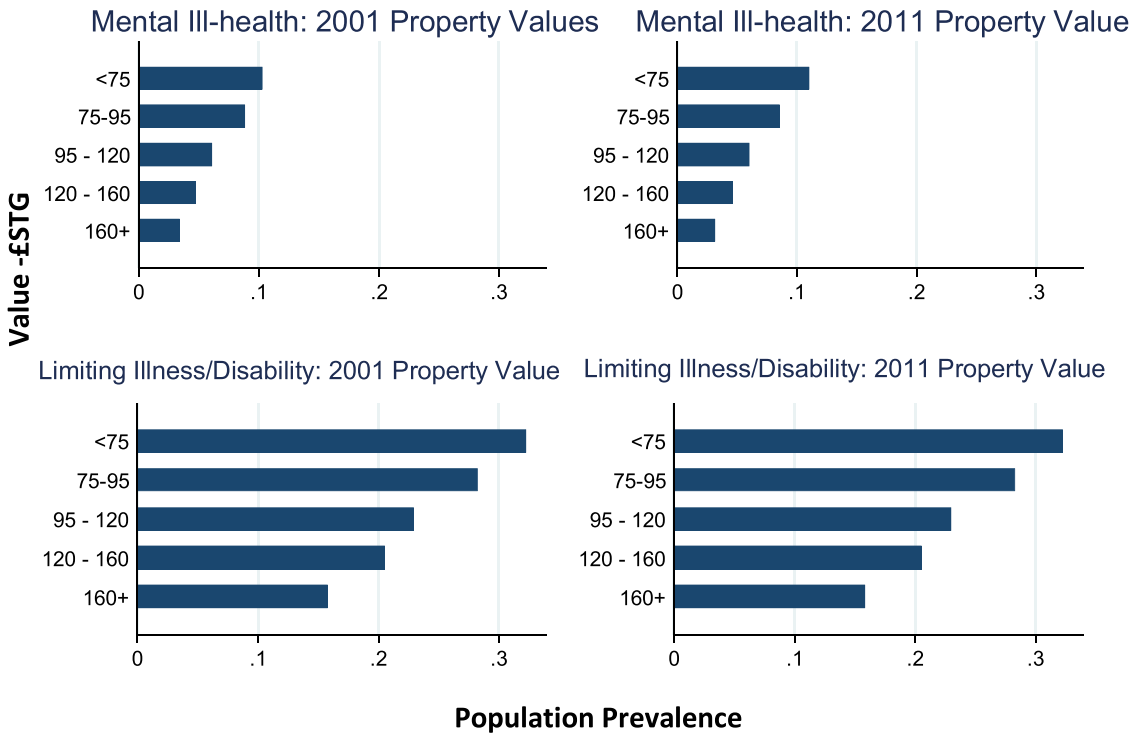

FIGURE 2 Prevalence of ill health by property value

proportion in both groups (<7%). Each house value category represented between 14% and 24% of each age group, with ~12% missing a value for 2001 and ~11% missing a value in 2011.[3]

Familiar socio-economic gradients are observable for both physical and mental ill-health distributions when expressed against bands of house value. Figure 2 demonstrates up to a twofold difference in prevalence of limiting illness between the lowest and highest property value categories.

Poor health is experienced least often by those in consistent affluence and most often by those in consistent deprivation. Figure 3 shows the distribution of both physical and mental ill health along each house value axis and among the 25 groups constituted by the baseline and endpoint house value categories. Both outcomes are observed more often among those in lower value homes in 2011, suggesting a more pronounced effect of current socio-economic conditions. A similar association with value band in 2001 is also apparent,

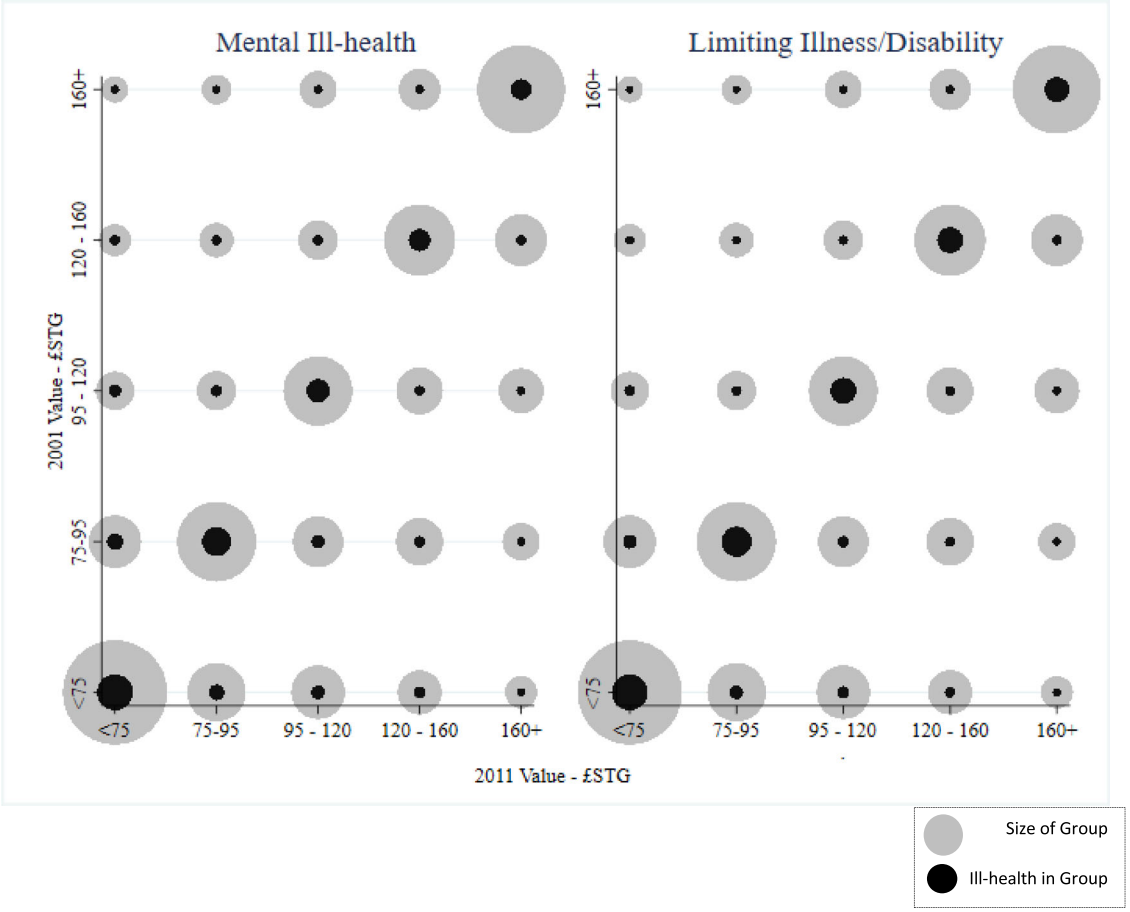

FIGURE 3 Scatterplot: Poor health by value transition

although this is weaker than the 2011 association. Furthermore, the effects of 2001 and 2011 values appear to interact, with ill health most prevalent among those in persistently low value homes but also noticeable in those who have made downward value transitions.

Logistic regressions presented in Table 2 show some support for an association between poor mental health and lower value housing in both early childhood and adolescent groups (Graphics of corresponding predicted probabilities appear in Figure 4). However, differences are only statistically significant when we compare along values of 2011 address property and between groups at either end of the value range. Comparing 2011 residents of homes valued at under £75,000 in the youngest age group, residents of homes valued at £160,000 or higher are estimated as approximately 50% less likely to experience poor mental health (OR = 0.49, CI: 0.31–0.78). Among persons of working age, there is a clear gradation, with risk to health reduced at each point on the property value scale.

Risk of physical disability was also correlated with value of current and prior address. However, the patterning of effects are different in these models. This could be considered as weak evidence that house value impacts more strongly on mental health than on physical health for this age group.

Moving to the "Mobility models" of ill health presented in Table 3, for working age people, risk of mental ill health was clearly higher for downward movers and somewhat reduced for upward movers. Whereas there is some evidence of a graded effect whereby, for example, a four-point decline (OR 2.44, CI: 1.96–3.04) incurs a greater hazard than a two-point decline (1.50, CI: 1.36–1.64), there is no corresponding gradation of effect for greater upward moves, all of which fall in a similar range. This pattern is replicated to some degree for limiting physical illness.

However, among the two younger groups, evidence of impact from moves between value bands is much less clear. For upward transitions, the only significant associations to do with mental health risk was for lower risk among youth aged 10–15 in 2011 who had made a one-point increase on the scale. Meanwhile, among those aged 6–15 years in 2001, making a three or four-point move to a more valuable address is associated with *greater* risk of physical disability, that is, the opposite association to the apparent protective effect observed for working age adults. Coefficients were in a similar range for mental ill health but did not meet the threshold for significance.

For the emerging adulthood group, value declines were associated with greater risk of mental and physical ill health, although evidence of graded effects was not clear. For the youngest group, coefficients were in a similar range of magnitude, although the only coefficient to meet the threshold for significance showed greater

TABLE 2 Risk of mental ill health (logistic regressions) 'starting advantage' and 'cumulative advantage' models

	Mental ill health						
		Youth		Emerging adulthood		Working age	
		33,862	34,090	48,854	49,915	212,621	219,918
	N	Starting advantage 2001 value (age 0–5)	Cumulative advantage 2011 value (age 10–15)	Starting advantage 2001 value (age 6–14)	Cumulative advantage 2011 value (age 16–24)	Starting advantage 2001 value (age 15–54)	Cumulative advantage 2011 value (age 25–64)
	R^2	0.05	0.05	0.10	0.09	0.13	0.12
House value (ref: <£75,000)	£75,000–£95,000	0.86 (0.61–1.21)	0.8 (0.56–1.15)	0.91 (0.79–1.05)	0.88 (0.77–1.02)	1.01 (0.97–1.05)	0.94* (0.9–0.98)
	£95,000–£120,000	0.95 (0.64–1.42)	0.8 (0.54–1.19)	0.90 (0.76–1.07)	0.84* (0.71–0.99)	0.88* (0.83–0.92)	0.8* (0.76–0.84)
	£120,000–£160,000	0.84 (0.53–1.31)	0.69 (0.45–1.06)	1.00 (0.83–1.2)	0.77* (0.64–0.92)	0.77* (0.73–0.81)	0.69* (0.65–0.72)
	£160,000+	0.74 (0.46–1.18)	0.49* (0.31–0.78)	0.74* (0.60–0.91)	0.65* (0.53–0.8)	0.59* (0.56–0.63)	0.5* (0.47–0.53)
	Limiting physical illness						
	R^2	0.06	0.06	0.07	0.07	0.21	0.21
House value (ref: <£75,000)	£75,000–£95,000	0.95 (0.84–1.08)	0.96 (0.84–1.1)	0.99 (0.89–1.09)	0.92 (0.83–1.03)	0.99 (0.96–1.03)	0.95* (0.92–0.98)
	£95,000–£120,000	0.87 (0.75–1.01)	0.88 (0.76–1.02)	1.08 (0.96–1.21)	1.03 (0.92–1.15)	0.85* (0.81–0.88)	0.82* (0.79–0.85)
	£120,000–£160,000	0.91 (0.78–1.07)	0.89 (0.76–1.04)	1.08 (0.96–1.22)	0.96 (0.85–1.08)	0.75* (0.72–0.78)	0.73* (0.7–0.76)
	£160,000+	0.75* (0.64–0.88)	0.77* (0.66–0.91)	0.85* (0.74–0.97)	0.82* (0.73–0.93)	0.6* (0.57–0.62)	0.54* (0.52–0.57)

Note: Controls: Age; Sex (not in "Youth"); Household structure in 2001; Prior ill health; Number of household members with limiting illness; Highest household NSSEC in 2001.
*$p < 0.05$.

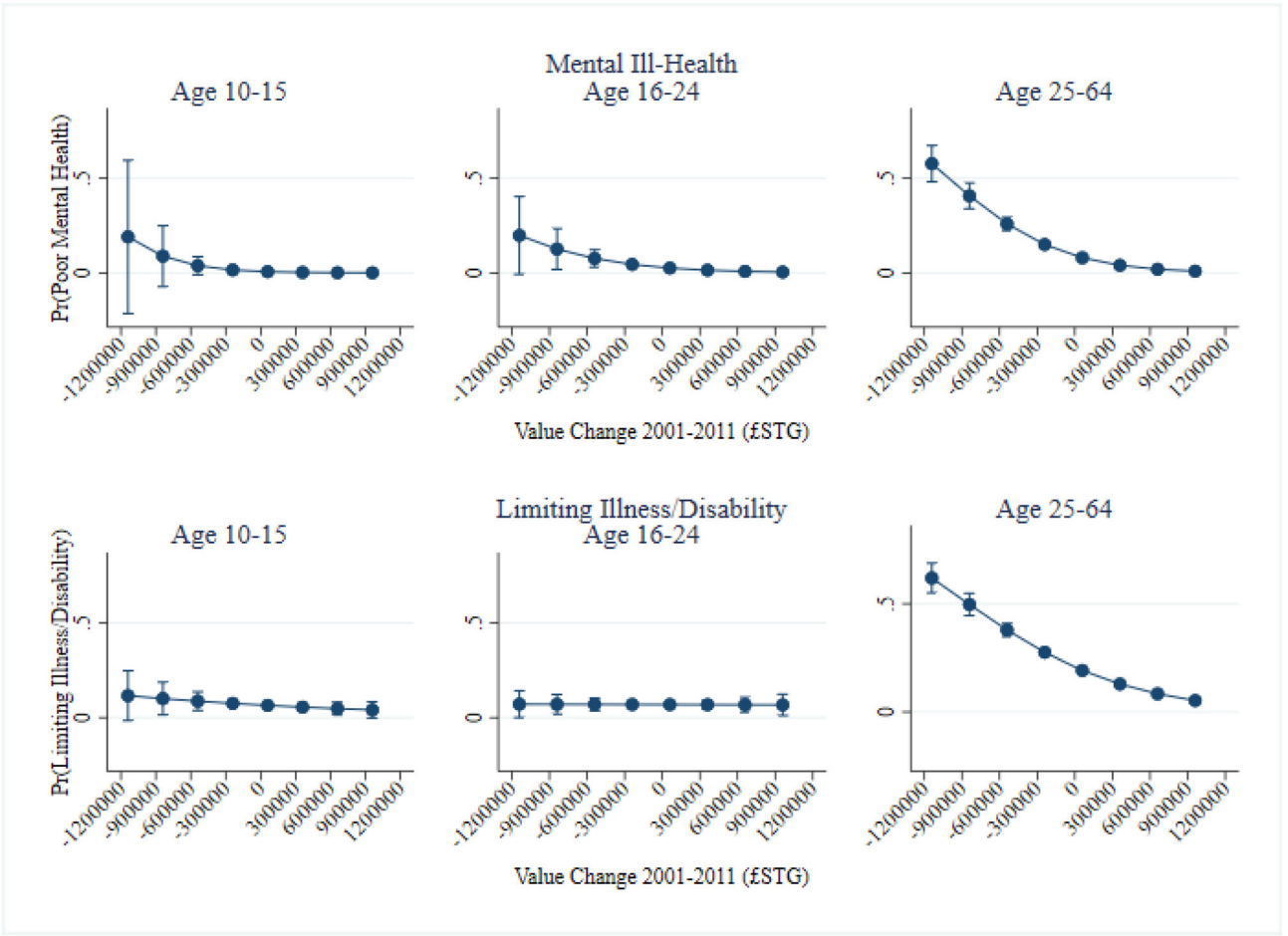

FIGURE 4 Predicted probability of poor health by house value transition

TABLE 3 "Mobility model": Logistic regression associations with house value transitions

			Mental ill health			Limiting physical illness	
	N	31,515	46,277	198,755	31,515	46,277	198,755
	R^2	0.05	0.10	0.13	0.06	0.07	0.21
		Youth	Emerging adulthood	Working age	Youth	Emerging adulthood	Working age
Decline	4-point	2.83 (0.37–21.58)	2.66* (1.41–5.02)	2.44* (1.96–3.04)	2.40* (1.07–5.39)	1.53 (0.85–2.76)	1.88* (1.56–2.28)
	3-point	1.56 (0.37–6.62)	2.3* (1.57–3.37)	1.82* (1.59–2.08)	1.64 (0.97–2.77)	1.42* (1.01–2.01)	1.33* (1.19–1.49)
	2-point	1.69 (0.76–3.78)	1.52* (1.12–2.07)	1.5* (1.36–1.64)	1.01 (0.71–1.45)	1.42* (1.13–1.8)	1.23* (1.14–1.33)
	1-point	1.4 (0.76–2.35)	1.62* (1.31–2)	1.32* (1.24–1.41)	1.12 (0.89–1.4)	1.28* (1.08–1.51)	1.12* (1.06–1.19)
Increase	1-point	0.59* (0.36–0.99)	1.03 (0.84–1.27)	0.96 (0.91–1.02)	1.03 (0.88–1.19)	1.12 (0.98–1.28)	0.9* (0.86–0.95)
	2-point	0.78 (0.45–1.36)	0.97 (0.74–1.26)	0.85* (0.79–0.92)	1.00 (0.83–1.2)	1.04 (0.88–1.24)	0.82* (0.77–0.87)
	3-point	0.65 (0.28–1.5)	1.28 (0.9–1.81)	0.8* (0.71–0.89)	1.11 (0.86–1.43)	1.32* (1.04–1.66)	0.75* (0.69–0.82)
	4-point	0.82 (0.2–3.51)	1.32 (0.69–2.53)	0.71* (0.57–0.89)	1.20 (0.75–1.92)	1.65* (1.1–2.49)	0.81* (0.68–0.95)

Note: Reference group for mobility is persons living at property of same value; Controls: Baseline house value; Age; Sex; Household structure; Prior ill health; Number of household members with limiting illness; Highest household NSSEC in 2001.

*$p < 0.05$.

likelihood of physical ill health among those whose families had moved from the highest property value band to the lowest,

Taking these results together, it is clear that a person's age and stage of life is an important factor to consider when assessing how socio-economic and residential may influence that person's health. While some of the patterning and nonpatterning in Table 3 may be due to smaller population subgroups in which significant associations are more difficult to detect, it does appear that associations with upward property value moves in particular vary substantially between the focal age groups.

5.1 | Sensitivity analyses

Downward moves in property value may impact health and quality of life. In the reverse direction, families of people with disabilities may have to move house to accommodate the needs of the disabled family member or to cut living costs so as to afford care. To examine the extent to which coefficients reflect this second scenario, we carried out a sensitivity test excluding persons reported as having long-term limiting illness in 2001. Coefficients did not change substantially.[4]

In Appendix A, we show results from a restricted version of the mobility model that excludes nonmovers and where the reference group is persons who moved address but to an address of the same value. If it was the case that the instability or upheaval was driving the health risks to movers, we would likely see changed coefficients in this table. We see little substantial difference, suggesting that upheaval is not the primary mechanism and that changes in housing and socio-economic conditions are more likely drivers of the observed associations. This supports the finding of Popham et al. (2014) that distress experienced in the period immediately around address change abated after a short period.

For the emerging adulthood group, we specified a model restricted to those young people whose address in 2011 was with their parents and therefore whose change in property value was not also associated with a move to independent living. Continuing to live with parents was associated with lower odds of poor mental health overall (OR 0.46, CI: 0.40–0.53) even adjusting for age within age group. Splitting the main model on this variable suggested less differential by property value change for those no longer living with parents, so we took the additional step of specifying a model testing for interaction between living with parents and house value change. In this model, there were significant interaction terms associated with young people living with parents making the greatest value decline (4-points; OR 3.39, CI: 1.01–11.35). For this category of downward property move, these models suggest that the mental-health risk is only significant for those living with parents. However, the less extreme points on the decline scale did not significantly interact with the living with parents dummy. Those registering the most extreme downward declines in this age group may have moved away from the family home for study or work: the benefits to mental health in those circumstances will often outweigh the material change in living conditions. Other declines in address value may be more heterogeneous in the circumstances they represent. An additional coefficient of interest in this model is an elevated risk of poor mental health for those living with parents and making a one-unit upward move in property value (OR 1.62, CI: 1.06–2.48). This supplements the previous discussion of apparently paradoxical associations observed for this age group and again suggests that more detailed ordering of events would be important to capture in a future study: it is plausible in this case that a person's mental ill health may lead to them staying longer with parents and may influence the family's decisions around address change, for example, in order to be in greater proximity to services.

For the working age population, which showed clear associations between health and address changes to lower value housing, we specified two additional versions of the model, each including three-way interactions with property value change: the first with 2001 and 2011 housing tenure and the second with 2001 and 2011 household structure. In each case, the sample size supported the model specification and the value change variable continued to be a significant independent predictor. A full summation of the interaction terms are beyond the scope of the current paper and would require careful specification to account for multiple possible sequences (such as marital dissolution leading to value change for one partner or both, or marital dissolution arising from a change of socio-economic circumstances). However, the pertinent finding is that across a range of circumstances, there remains a robust association between property value change and health indicators as described above and further discussed in the ensuing section.

6 | DISCUSSION

Using a large, representative sample derived from linked administrative datasets, this study found no evidence of a protective health effect of upward social mobility, as expressed by change of address to a higher value property, at any stage in the life course. House value is strongly predictive of health outcomes: people of all ages occupying homes rated as higher value report ill health less frequently. Socio-economic disadvantage and poverty are central drivers of poor ill health in the population, and our analysis gives no evidence to suggest that upward economic shifts may undo the harm caused by prior disadvantage.

The results offer partial and conditional support to our central hypothesis. We found no evidence for beneficial effects of upward social mobility on health, whereas the effect of downward mobility depends on the person's life stage. In childhood, there is little evidence suggesting greater ill health after downward family transitions, but evidence of a social detriment appears in adolescence and early adulthood. By comparison, using people of working age as a comparator group, we find robust evidence of greater ill health among those who experience downward transitions. There is a greater possibility here that two simulataneous causal processes will inflate to this association, with poor health causing downward transitions for some, and occurring because of downward transition for others. This remains a key limitation of using observational UK Census data for this type of

analysis: within a 10-year time period, many changes can occur, such as educational attainment, occupational change, and changes in housing tenure and household structure, and these can change in a variety of sequences. Thus, our finding that downward moves between properties of higher and lower values are associated with higher risk of poor health is not a causal claim. In this sense, the null finding of the absence of any corresponding independent association between upward moves and lower health risk may be the more significant element of this study.

The central finding suggests that policy-makers focused on increasing social mobility should not expect a health dividend to persons who are upwardly mobile. The overall social gradient of health suggests that it is more likely, rather, that alleviating the experience of household poverty prior to having children will see health advantages accrue to the family. Furthermore, it is worth highlighting the finding that working age people experience detrimental health effects accruing from transitions to lower value homes, whereas we have no evidence of a protective health effect from an upward transition. There are several possible interpretations of this. It may be that the salutogenic effects of moving to a higher value home are directly "cancelled out" by the detrimental effects of prior exposure to low value housing. Alternatively, this may be an example of the emotional response to a loss being of greater salience and magnitude than that of a gain, along the lines suggested by the prospect theory (Kahneman & Tversky, 1979). Limiting analysis to only persons who experienced a move suggested that residential instability was not a major contributor to the observed effect.

Taken together, our results suggest social protection policies and measures such as mortgage debt relief schemes, aimed to keep people in their homes, or interventions to improve the quality and availability of housing stock may be more effective in reducing population-level ill health than policies focused on facilitating progression up the property ladder.

6.1 | Additional strengths and limitations

This study is unique in exploiting house value data at the individual level as a proxy for affluence. We have been cautious in our interpretation of the mechanisms underlying the observed associations between residential moves and ill health. First, the associations, while nontrivial in magnitude, are imprecisely estimated, as captured by the wide confidence intervals around estimated associations. Second, the direction of causality is difficult to infer, even with the availability of a large array of 2001 control variables used to limit sources of confounding. For example, a child developing a disability, or poor mental health, may prompt a family to make either an upward transition (e.g., moving to a larger home or one with appropriate adaptations) or a downward transitions (e.g., due to loss of income through care requirements).

An additional limitation is the temporal gap between the 2005 property valuation exercise and the two observation points. This necessitates the assumption that value remains relatively stable between 2001 and 2011 or that the relative value of properties remains reasonably constant throughout any inflationary or deflationary period. However, house prices remained stable in NI, and the price categorisation allows for an upwards or downwards change in market price of £20,000 without a change in pricing category.

The available health outcomes are rudimentary binary indicators of illness category. The 2011 Northern Ireland Census was novel in disaggregating sources of ill health and disability, but categories remain crude. However, NILS have proven to be good indicators of health (Young et al., 2010).

7 | CONCLUSIONS

Our findings do not support the expectation that upward social mobility provides health benefits for children who begin their lives in deprived households. Our principal recommendation is that, from the perspective of public health, social protection policies that aim to prevent slides into poverty are likely to have a greater impact than social activation-style initiatives that seek to facilitate moves from deprivation to affluence. This may help to explain why population health has been found to be greater in countries with more redistributive models of political economy (McCartney et al., 2019).

Furthermore, the idea that the early years of life constitute a critical period in which the effects of poverty are most profound and long lasting is accepted among policy makers, and early years intervention is already a high priority spending area in many countries. However, the current study reminds us that healthy development can be disrupted beyond the early years and that movement to either better or worse residential circumstances could be detrimental to the health of adolescents.

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DATA AVAILABILITY STATEMENT

The authors are committed to the principles of transparency and replicability as keys to maintaining the highest scientific standards. Access to the Northern Ireland Longitudinal Study is through a Secure

Environment maintained by the Northern Ireland Statistics and Research Agency (NISRA) and is subject to researcher accreditation and approval of a defined project. Researchers wishing to replicate this analysis should contact the authors in the first instance. Further information pertaining to variable definitions, analysis protocol and sensitivity testing is available via the Open Science Foundation: https://osf.io/kj4n9/ (DOI 10.17605/OSF.IO/KJ4N9).

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ENDNOTES

[1] NILS is explained in detail by O'Reilly et al. (2012). Ethical approval for NILS was granted by the Office for Research Ethics Committees Northern Ireland (OREC-NI).

[2] Data matching is carried out by the Northern Ireland Statistics and Research Agency (NIRSA). Researchers could not access address records, and all participant identification is removed for the purpose of analysis.

[3] Missing values likely accrue from a failure to match addresses to the 2005 valuation exercise; census addresses may include addresses not operational in 2005. Persons with missing house values are excluded from regression analyses, with the assumption that this information is missing at random.

[4] Full results for all sensitivity analyses are available at https://osf.io/kj4n9/ (DOI 10.17605/OSF.IO/KJ4N9). We are grateful to an anonymous reviewer for their in-depth feedback on these analyses and suggestions for additional testing.

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APPENDIX A

TABLE A1 Mobility model (nonmovers excluded): Logistic regression associations with house value transitions

			Mental			Limiting illness	
		Childhood	Adolescent	Working age	Childhood	Adolescent	Working age
Decline	4-point	3.62 (0.43–30.83)	2.29* (1.18–4.45)	2.54* (2.02–3.2)	2.9* (1.25–6.76)	1.47 (0.8–2.69)	1.99* (1.63–2.42)
	3-point	1.79 (0.39–8.26)	1.89* (1.25–2.86)	1.9* (1.65–2.19)	1.79* (1.04–3.09)	1.4 (0.98–2.01)	1.46* (1.29–1.65)
	2-point	2.1 (0.86–5.13)	1.24 (0.89–1.72)	1.51* (1.36–1.67)	1.1 (0.75–1.61)	1.39* (1.08–1.78)	1.32* (1.21–1.44)
	1-point	1.35 (0.72–2.52)	1.3* (1.03–1.63)	1.3* (1.2–1.4)	1.18 (0.92–1.5)	1.17 (0.98–1.41)	1.17* (1.09–1.24)
Increase	1-point	0.56* (0.32–0.98)	0.82 (0.66–1.01)	0.92* (0.86–0.98)	1.04 (0.88–1.24)	1.04 (0.9–1.21)	0.91* (0.86–0.96)
	2-point	0.72 (0.4–1.32)	0.76 (0.57–1)	0.81* (0.74–0.88)	1.01 (0.82–1.25)	0.97 (0.8–1.17)	0.82* (0.76–0.87)
	3-point	0.55 (0.23–1.31)	0.99 (0.69–1.42)	0.74* (0.66–0.84)	1.11 (0.84–1.46)	1.19 (0.93–1.52)	0.73* (0.67–0.8)
	4-point	0.7 (0.16–2.97)	1.03 (0.53–1.99)	0.65* (0.52–0.81)	1.21 (0.75–1.97)	1.5 (0.99–2.27)	0.76* (0.65–0.9)

Note: Reference group for mobility is persons living at property of same value; Controls: Baseline house value; Age; Sex; Household structure; Prior ill health; Number of household members with limiting illness; Highest household NSSEC in 2001.

*$p < 0.05$.